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UTILITY APPLICATIONS OF TIME SENSITIVE NETWORKING WHITE PAPER

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How TSN could be used in a utility operational network

In the context of this white paper, the utility is considered an entity (or entities) that manages the distribution of electricity on the transmission grid and the distribution grid. The power distribution network involves substations, and various protective and control devices that communicate over communications networks.

Low latency or “real-time” performance of the network is important for specific grid use cases and applications.

The real-time behavior of Ethernet based communication networks is defined in IEC 61784-2. There are six (plus one technology specific) consistent sets of parameters described to define the requested and achieved Real-time Ethernet behavior of end-to-end stations. For the network components, using TSN is an effort ongoing in IEC SC 65C.PT61784-6, dealing with a TSN profile for industrial automation applications.

Teleprotection

Protective relays protect electrical transmission lines against fault conditions (line down, short circuits between conductors or to ground). Simple protection schemes measure voltage and current at one end of the transmission line. Differential protection schemes determine fault conditions by measuring real-time differences in voltage and current between the ends of the line. This requires an independent communication link with very low (< 10 mS) end-to-end latency to carry the measurements between the relays at the ends of the line. The communication link latency must be highly consistent and predictable. The latency requirement is less than one cycle of the ac waveform (16.6 mS or 20 mS), because time must be allowed for the mechanical operation of the relay in the case of a fault.

The communication link connection is typically fiber, although copper circuits are also used. Power Line Carrier and point-to-point microwave are less commonly used.

Intra-substation LAN

Support for IEC 61850 Generic Object Oriented Substation Event (GOOSE) messages for controlling relays and switches within the substation. TR 61850-90-13 addresses the following:

- Type of connection – typically Ethernet (copper or fiber)
- GOOSE and MMS traffic.
- TSN could be a help on the process bus.

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